

In the Caucasus, *Juglans* is represented by the Common Walnut, *J. regia*, occurring throughout Transcaucasia on the mountain slopes in the deciduous forests, sometimes ranging to an altitude of 1500 metres above the sea but only in the form of the cultivated tree reverted to its wild condition.¹ It apparently represents a survival of ancient native cultivation, became acclimatized and disseminated in the forests and although cut without discrimination is still preserved thanks to its high reproductive power. Remains of some kind of dwelling denoting the former presence of man, as a stone wall, broken bits of pottery, may usually be found in the vicinity of Walnut trees. Until quite recently *J. regia* L. has been considered indigenous to Talysh alone on the Persian frontier, but the latest investigations and observations of Prof. A. A. Grossheim, a well known specialist on the Talish flora, show that even in that locality the Walnut was formerly a cultivated tree. In any case, the range of the above mentioned species throughout the Caucasus and the diverse varieties, both wild and cultivated, require a detailed study.

Juglans regia L. is likewise found in the western part of Turkestan,² namely in the wooded gorges of the Kopet-Dag mountains. The arboreal vegetation of these gorges is but a scanty remnant of the former Astrabad moist forests. Here *Ficus carica* L., *Punica granatum* L., *Zizyphus vulgaris* L. are met with, as well as certain Caucasian plants, such as *Allium paradoxum* Don, peculiar but to the dense Transcaucasian virgin forests and a special form of *Iris acutiloba* C. A. M. separated as a distinct species. The influence of man having been exerted since a very early period, and several waves of peoples having left traces, it is sometimes difficult to decide whether the huge old Walnuts so often met with near brooks and streams are cultivated or wild trees. In any case, the region mentioned forms the extreme northern limit of *J. regia* L. Further East this species is supplanted by a closely related one, *J. fallax* Dode, characterized by small rounded hard-shelled fruit with a small kernel. This species is spread all over the Tian-Shan, namely the Pskem-Ugam mountains, the Chatkal and Fergana chains as likewise the Tadjikistan mountains (Gissar and Darvaz). In all these regions *J. fallax* enters into the composition of the broad-leaved forests forming its first story. In these forests the Walnut is associated with other trees, such as various representatives of the Maple (*Acer Semenowi* Regl. & Herd., *A. turkestanicum* Pax), Ash (*Fraxinus potamophila* Herd. and *F. sogdiana* Bge.), numerous varieties of the Apple-tree, with an underwood of various shrubs, such as: *Prunus cerasifera* Ehrh., *Prunus Mahaleb* L., the endemic shrub *Exochorda Korolkowi* Lavallé, *Evonymus Semenowi* Rgl. & Herd., *Abelia corymbosa* Reg. & Schmalh. and a number of others.

It seems worth noting that among the herbaceous vegetation are commonly found such northern forest plants as *Brachypodium silvaticum*

¹ It should be noted that in western Europe the Walnut ranges to the altitude of 1100-1300 metres, in the Tyrol of 1255 metres, in the Jura of 1070 metres.

² NEKRASSOWA, V. L. The genus *Juglans* in Turkestan. (Bull. Appl. Bot. xviii. 301 [1928]).

(Huds.) P. B., *Agropyrum caninum* (L.) R. et S., *Poa nemoralis* L., *Geranium silvaticum* L., *Brunella vulgaris* L., *Trifolium pratense* L., *Potentilla reptans* L., *Crepis sibirica* L., *Picris hieracioides* and others. Among the commoner plants is the shade-seeking *Impatiens parviflora* DC., a native of Turkestan, well acclimatized in western Europe and always found near dwellings.

In these forests, spreading over valleys and mountain gorges, Walnuts are always connected with damp and abundantly watered localities in the vicinity of water. The soils under these forests are very interesting: they are of a dark colour with a violet tinge, have a large content of humus and a peculiar structure. Occasionally Walnuts ascend on mountain slopes to a considerable altitude, up to 1850 or even 1915 metres, but always in damp places. In spring during the blossoming of apple- and plum-trees, walnut forests present a lovely sight, while in autumn, when all the trees and bushes are covered with ripe fruit they recall a beautiful garden. The local inhabitants call them "gardens" and during the summer months come to them for a rest-cure from the heat and malaria, while in autumn they are visited for collecting different fruits.

J. fallax Dode in Turkestan and *J. regia* L. in the Caucasus bear edible fruits which are exported in great quantities to the large towns of the Union. The leaves are used for medicinal purposes and the unripe husk yields a brown dye employed by the natives for dyeing homespun materials. But the greatest value of the Walnut lies in the wood itself and especially in the burl, an overgrown knot or excrescence on the trunk, which is greatly valued for veneer by cabinet-makers. Large quantities of burl are annually taken off the trees and exported to other countries.

Throughout the Caucasus and Turkestan, in every garden trees of *J. regia* L. may be met with, while a closely related species—*J. kumaonia* Dode—with very large fruits highly valued in the trade is sometimes found in the Zeravshan.

Outside the boundaries of the Union of S. S. R. *J. regia* L. extends over the Balkan peninsula, Asia Minor and Persia; *J. fallax* Dode into Persia, Baluchistan and India (according to Dode).

Under somewhat different conditions and in other surroundings occurs in the Far East the section of *Cardiocaryon*¹ consisting of *J. mandshurica* Maxim., *J. stenocarpa* Maxim., and *J. cathayensis* Dode. These three species closely related to each other are often treated as one under the determination of *J. mandshurica* Maxim.² And yet, they exhibit certain dissimilarities. Thus, *J. mandshurica* has viscid female flowers covered with glandular hairs, young leaves thickly covered with glands, and mature leaves

¹ WOLF, E. Die mandschurischen Wallnüsse. (Mitt. Leningrad Forstinst. xxxiii. [1926]).
SKVORTZOW, B. W. Fragmenta Florae Manshuriaae. (Bull. Jard. Bot. Princ. U. R. S. S. xxvi. [1927]).

WOLF, E. Die mandschurischen Wallnüsse. (op. cit. xxvii. 349–352. [1928]).

STROGI, A. A. The manchurian walnut. (Bull. Appl. Bot. xviii. no. 2, p. 247–302 [1928]).

SKVORTZOW, B. W. The Manchurian Walnut. (Manch. Research Soc. ser. A., fasc. 32 [1929]).

² KOMAROV, V. Act. Hort. Petrop. xxii. 9 (Fl. Manshur. ii. [1903]).

with a glabrous upper surface, while the narrow elongated leaflets are acuminate, the fruits being ovate, of a dirty brown dull colour and show numerous uneven cavities. The flowers of *J. stenocarpa* Max. are thickly covered with hairs being destitute of glands; the young leaves are tomentose, the mature leaves covered with stellate hairs, the leaflets being short and acuminate, the fruit elliptical, glossy and brown with 4 large equal and several smaller cavities. The third species, *J. cathayensis* Dode, is related to *J. stenocarpa* Maxim, but differs in having hard thick, less hairy leaves with smaller indentations; the venation of the leaves is more pronounced; the testa of the seed dark brown, the fruit having a more constant form and numerous cavities. All these features are described by E. Wolf from his observations of species grown at the nurseries of the Institute of Forestry and at the Botanical Garden of Leningrad.

In the Far East the Walnut grows in the valleys of rivers and small streams being most frequently found in abundantly watered gullies and narrow gorges and occurs in mixed forests containing *Pinus koraiensis*, *Abies holophylla*, *Picea ajanensis*, *Acer mandshuricum*, *A. Mono*, *Fraxinus mandshurica*, *Ulmus campestris* and others, as well as in purely deciduous forests without any admixture of conifers. The Manchurian Walnut likewise occurs on river banks among a growth of various Willows, *Alnus hirsuta*, *Ulmus pumila*, *Prunus padus*, all the trees and shrubs there being entwined by the climbing plants of *Vitis amurensis*, *Calystegia rosea*, *Cuscuta japonica* and of other lianas; on the northern confines of its range it affects rocky slopes. It should be noted that in these regions the Walnut does not form pure close stands, but occurs in scattered individuals among the trees of the first story and even in the underbrush. It does not seem to ascend the mountain above an elevation of 300 metres. As it recedes from the centre of its range *J. mandshurica* exhibits a tendency to grow on southern well insulated slopes and gradually ceases to produce ripe fruit. The northern limits of its range appear to be the lower reaches of the rivers Bureja and the Girin, the neighborhood of Sofijsk and Borbi (51° 15' N. L.), while single specimens may be found on the upper and middle reaches of the river Tumdja which falls in to the Soviet Harbor (49° N. Lat.). Outside the Union of S. S. R. *J. mandshurica* Maxim occurs on the mountains of Manchuria (Chan-Guan-Wai-Lin) and of the Small Khingan, in northern Korea and in Jegol on the Eastern frontier of Mongolia. The geographical range of the two other species is not yet ascertained. Maximovicz¹ has recorded *J. stenocarpa* from the boundaries of Korea and, according to Dode, *J. cathayensis* Dode has an extensive range from the Amur to Szechuan and Hupeh, but as many specimens of *J. mandshurica* Maxim. from the Amur have been relegated by this author to *J. cathayensis* Dode, this indication needs further confirmation. Skvortsov² who has studied these trees in Manchuria maintains that they are

¹ MAXIMOWICZ in Bull. Acad. Sci. St. Pétersb. xviii. 57-59 and in Mém. Biol. viii. 630-632. (Diagn. Plant. Nov. Jap. Mandsh. Dec. xii.) (1872).

² SKVORTZOW, B. W., l. c.

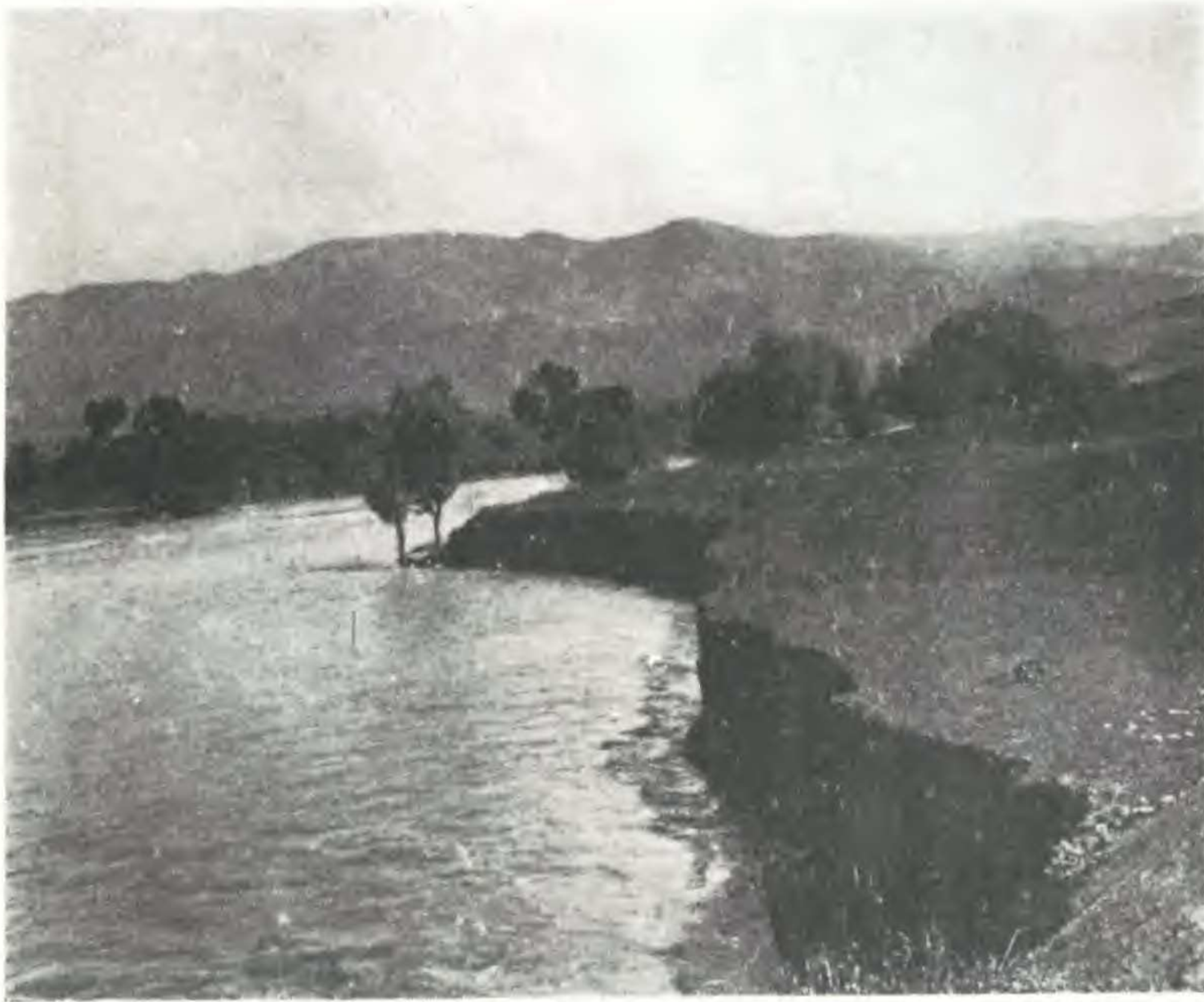
there represented but by *J. mandshurica* Max. which in that region is distinguished by the form of fruit being subject to much variation.

All three species mentioned yield a very valuable wood for cabinet work as well as for aeroplanes and gunstocks but fail to produce burls similar to those of *J. regia* L. and *J. fallax* Dode. On account of the great strength of the timber the Koreans of Nikolsk-Ussurisk manufacture a special kind of wooden shoes called ni-van-seni from this tree. In consequence of the small size of its kernel and the hardness of the shell the nuts, although containing a high proportion of oil are seldom eaten. As an ornamental tree the Manchurian walnut is of much value on account of the rapidity of its growth, its capacity of developing a fine crown when growing in the open, longevity, freedom from infection and adaptability to different climates. Thus, the Manchurian walnut grows, for instance, in those parts of Manchuria where the mean annual temperature is but 2.6°, the winter being extremely cold, the summer hot and rainy and the period of vegetation only lasting 151 days.

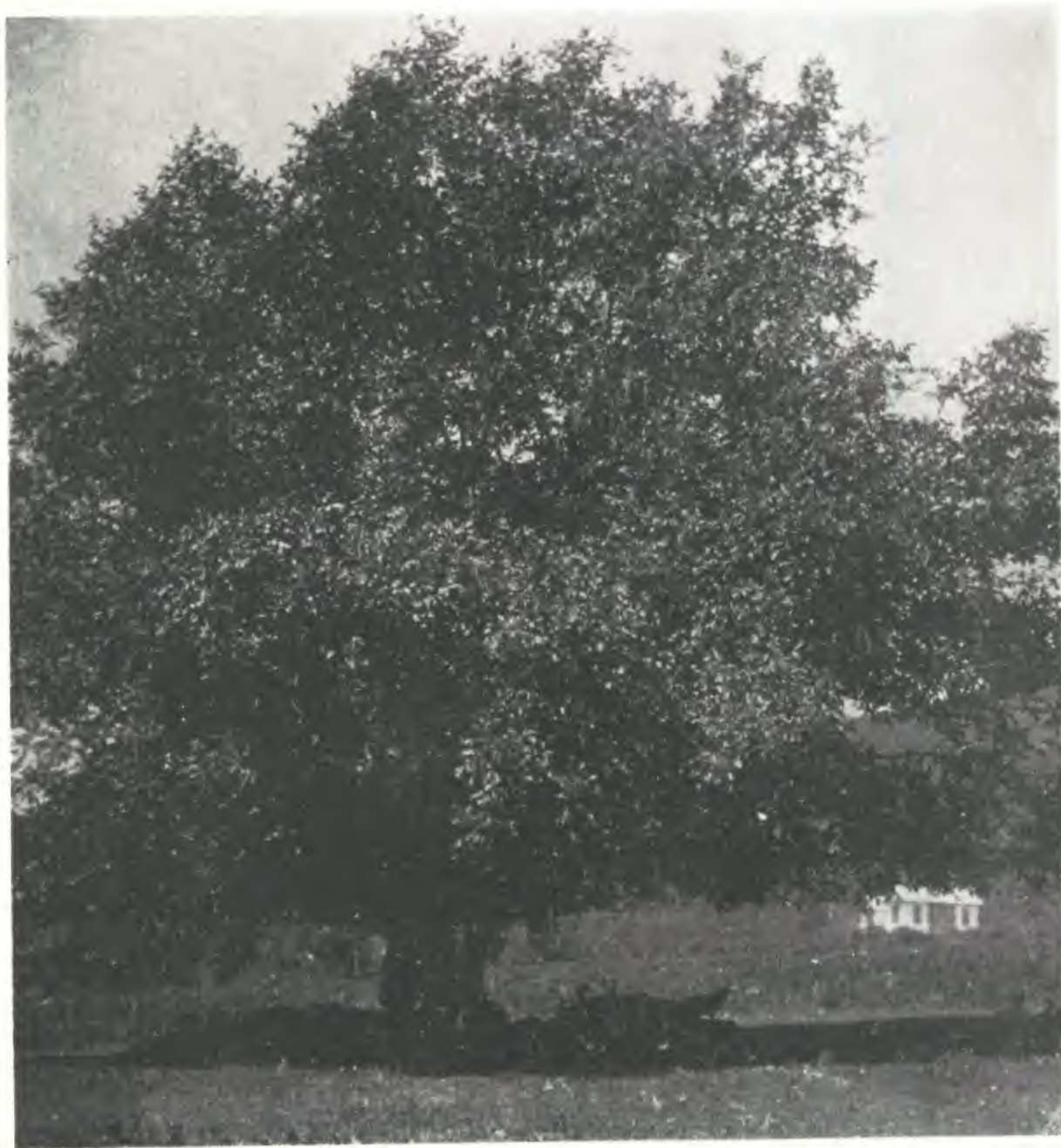
Pterocarya, the other genus of Juglandaceae, consists of 7 species occurring chiefly in Central China (5 species), one species in Japan and *P. caucasica* C. A. Mey in the Caucasus and in Northern Persia. Within the Caucasus, *P. caucasica* is, like the Walnut, met with in the forests of Kolkhida and Lencoran, but while the Walnut is always connected with mountain slopes, this tree, on the other hand, grows but in very damp places chiefly along the river valleys. In western Transcaucasia, *P. caucasica*¹ occurs in the Batum lowlands, in Guria, Mingrelia, Imeretia, Abkhazia and the Chernomorsk government, the northern limit being the lower course of the river Shakhé near Sochi and its eastern near the town of Kutais. Within its range in all these regions this tree never ascending even the nearest foot hills occurs exclusively in swampy or low lying country subject to continuous flooding and it grows among alders—*Alnus glutinosa* Gaertn., various Willows and the Caucasian Blackberry, *Rubus caucasicus*, under whose shade flourish innumerable plants of the fern *Matteucia Struthiopteris*. *Pterocarya caucasica* C. A. Mey likewise grows in Georgia all over the valley of the river Alazan; in Azerbeidjan on all the lowlands adjoining the foot-hills as far as the Nukha and probably occurring in the region of the river Kuba. In Talysh² *P. caucasica* C. A. Mey grows along the banks of streams as well as on the sea coast in swampy places overgrown with *Alnus barbata* C. A. M. A number of various lianas and the endemic Lencoran Blackberry, *Rubus Raddeanus* Focke, characterize these forests. *Pterocarya caucasica* C. A. Mey thrives also in the forests of the lower and sometimes middle mountain zones, where the soil at the bottom of the gorges is ever moist, and torrential streams appear after heavy rain. The chief denizens of these forests are the "iron tree," *Parrotia persica* C. A. M., and the majestic Ghirkan, *Acer insigne* Boiss., characteristic of these

¹ MEDWEDJEW. Trees and bushes of the Caucasus. (1919).

² GROSSHEIM, A. The vegetation and the flora of Talysh. (Tiflis, 1926).



Clumps of *JUGLANS REGIA* L. in the valley of the Abashy River in Mingrelia, Western Caucasus.



Old planted tree of *JUGLANS REGIA* L. in Krasnaya Polyana, western Caucasus.

woods. Among the elements of the mountain forest should also be mentioned *Carpinus Betulus* L. and *Quercus castaneaefolia* C. A. Mey., as well as the Alder, *Alnus subcordata* C. A. Mey., typical of coast region forests. In the herbaceous covering are conspicuous the endemic plant of Ghirkan, *Solanum Kieseritzkii* C. A. Mey., the rare *Myriactis Gmelini* DC., while the most widely diffused are *Ilex aquifolium* L., *Danaë racemosa* (L.) Moench and various ferns which attain a luxuriant growth and frequently predominate over other types.

Beyond the Union of S. S. R. *P. caucasica* C. A. Mey., occurs but in the damp forests of northern Persia.

Pterocarya caucasica grows with great rapidity, lives long and reaches huge dimensions (up to 1 or 1.5 metres in diameter). Its wood is soft and not durable and is therefore used but for the manufacture of domestic articles such as cups, bowls, trays, tubs, troughs, etc. while shoes and cords for fastening boughs of growing vine as also shingles for roofs are made from its bast. The bark yields a very good tanning material. This tree is now being planted in moist places and along canals and ditches.

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CHROMOSOME NUMBER AND BEHAVIOR IN THE GENUS SYRINGA

Plate 21

KARL SAX

Most of the horticultural varieties of *Syringa* have been obtained from the species *vulgaris*, although *S. persica* and some of the *Villosae* lilacs are of considerable horticultural importance. The majority of the other species are not commonly grown, although some of them have considerable merit especially from the plant breeders standpoint. *Syringa pubescens* is one of the most fragrant of all lilacs but the flowers are not so attractive as those of the Common Lilac. *Syringa pinnatifolia* is also very desirable because of its unusual foliage and habit of growth, but the flowers are borne in small clusters and are rather inconspicuous. These two species should be especially valuable for breeding work. Combinations of the early blooming *vulgaris* varieties with the late *Villosae* species would undoubtedly be of value if they could be made. The Persian lilacs also offer interesting possibilities if they could be used in crosses with other species.

Considerable breeding and selection has been done with *S. vulgaris* and hundreds of new varieties have been introduced during the past fifty years. The work of Lemoine in France has been most conspicuous. New varieties have also been developed by John Dunbar in Rochester, New York, and by several nurserymen in Germany and Holland. Crosses have also been made between different species but comparatively few

of the horticultural varieties have been originated in this way. *Syringa chinensis*, one of the earliest species hybrids in the genus, is a hybrid between *S. persica* and *S. vulgaris*. Lemoine crossed *S. oblata* and *S. vulgaris* and obtained a number of desirable varieties which are known under the name *hyacinthiflora*. Miss Preston in Canada crossed *S. reflexa* and *S. villosa* and obtained desirable new varieties. The cross between *S. Josikaea* and *S. villosa* is known as *S. Henryi*, after the hybridizer, and some of these hybrids have considerable merit. In all cases the above crosses have been made between closely related species.

Attempts to cross species of the Vulgares group with those of the Villosae group have been made by Lemoine, Miss Preston, Skinner and others but, according to Mrs. McKelvey (4), hybrids have never been obtained between these two groups of lilacs.

According to Rehder (5) there are about 25 cultivated species of *Syringa*. *Syringa vulgaris* and *S. Josikaea* are native of southeastern Europe, *S. persica* is naturalized in western Asia, and *S. emodi* is indigenous on the western Himalayas. All other species are from eastern Asia.

The genus *Syringa* is divided into two subgenera, *Eusyringa* (K. Koch) and *Ligustrina* (Rupr.). The first subgenus is further divided into two groups, *Villosae* (Schneid.) and *Vulgares* (Schneid.). The *Villosae* group contains the species *emodi*, *yunnanensis*, *Josikaea*, *Wolfii*, *Sweginzowii*, *villosa*, *tomentella*, *reflexa*, and *Komarowi*. The *Vulgares* group includes *Julianae*, *velutina*, *microphylla*, *Palibiniana*, *pubescens*, *Meyeri*, *oblata*, *vulgaris*, *chinensis*, *persica* and *pinnatifolia*. The subgenus *Ligustrina* contains only three species, *pekinensis*, *amurensis* and *japonica*.

THE VULGARES GROUP

Syringa vulgaris shows some variation in chromosome number. The variety "Beranger" has 24 pairs of chromosomes which divide regularly in the reduction divisions of the pollen mother cells. The chromosomes at the metaphase of the heterotypic division are shown in figure 1. One pair of chromosomes is consistently larger than the others and can usually be identified in most of the *Vulgares* species.

In the variety "Dr. Nobbe" there are 23 bivalents and one univalent at reduction. In figure 2 the bivalents are shown at the poles, although they cannot be counted in this figure, and the lagging split univalent is shown. In figure 3 the 23 chromosomes are shown at one pole. In this cell 23 chromosomes could be counted at each pole with the lagging chromosome between. The same type of chromosome behavior was found in the variety "Princess Marie."

There are 24 pairs of chromosomes in *S. pinnatifolia* including a large pair similar to that found in the *vulgaris* varieties. Chromosome behavior is regular during the reduction divisions. Figure 4 shows the chromosomes at the first metaphase. *Syringa pubescens* also has 24 pairs of chromosomes (fig. 5).